

The opinion in support of the decision being entered today was **not** written for publication and is **not** binding precedent of the Board.

Paper No. 21

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Ex parte MITSUHIRO NAKAMURA, MASARU WADA, CHIHIRO UCHIBORI
and MASANORI MURAKAMI

Appeal No. 2000-0456
Application 08/809,463

HEARD: October 24, 2000

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PAT. & T.M. OFFICE
BOARD OF PATENT APPEALS
AND INTERFERENCES

Before HAIRSTON, JERRY SMITH, and LEVY, Administrative Patent Judges.

JERRY SMITH, Administrative Patent Judge.

DECISION ON APPEAL

This is a decision on the appeal under 35 U.S.C. § 134 from the examiner's rejection of claims 1-19, which constitute all the claims in the application.

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The disclosed invention pertains to a multi-layered structure for forming an ohmic electrode. More particularly, the ohmic electrode comprises at least a III-V compound semiconductor body, a non-single crystal semiconductor layer comprising indium over the semiconductor, and a metal nitride film over the indium layer.

Representative claim 1 is reproduced as follows:

1. A multi-layered structure for fabricating an ohmic electrode, comprising a non-single crystal semiconductor layer comprising In and a film including at least a metal nitride film which are sequentially stacked on a III-V compound semiconductor body.

The examiner relies on the following references:

| | | |
|--|-----------|---------------|
| Jackson et al. (Jackson) | 5,098,859 | Mar. 24, 1992 |
| Ishihara (Japanese) | 59-66166 | Apr. 04, 1984 |
| Nirschl et al. (Nirschl) (Japanese) | 4-129647 | Apr. 02, 1992 |

Claims 1-19 stand rejected under 35 U.S.C. § 103. As evidence of obviousness the examiner offers Jackson in view of Nirschl with respect to claims 1-4, 7, 9-14, 17 and 19, and the examiner adds Ishihara with respect to claims 5, 6, 8, 15, 16 and 18.

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Rather than repeat the arguments of appellants or the examiner, we make reference to the briefs and the answer for the respective details thereof.

OPINION

We have carefully considered the subject matter on appeal, the rejections advanced by the examiner and the evidence of obviousness relied upon by the examiner as support for the rejections. We have, likewise, reviewed and taken into consideration, in reaching our decision, the appellants' arguments set forth in the briefs along with the examiner's rationale in support of the rejections and arguments in rebuttal set forth in the examiner's answer.

It is our view, after consideration of the record before us, that the evidence relied upon and the level of skill in the particular art would have suggested to one of ordinary skill in the art the obviousness of the invention as set forth in claims 1-19. Accordingly, we affirm.

In rejecting claims under 35 U.S.C. § 103, it is incumbent upon the examiner to establish a factual basis to support the legal conclusion of obviousness. See In re Fine, 837 F.2d 1071, 1073, 5 USPQ2d 1596, 1598 (Fed. Cir. 1988). In so doing, the examiner is expected to make the factual determinations set forth

in Graham v. John Deere Co., 383 U.S. 1, 17, 148 USPQ 459, 467 (1966), and to provide a reason why one having ordinary skill in the pertinent art would have been led to modify the prior art or to combine prior art references to arrive at the claimed invention. Such reason must stem from some teaching, suggestion or implication in the prior art as a whole or knowledge generally available to one having ordinary skill in the art. Uniroyal, Inc. v. Rudkin-Wiley Corp., 837 F.2d 1044, 1051, 5 USPQ2d 1434, 1438 (Fed. Cir.), cert. denied, 488 U.S. 825 (1988); Ashland Oil, Inc. v. Delta Resins & Refractories, Inc., 776 F.2d 281, 293, 227 USPQ 657, 664 (Fed. Cir. 1985), cert. denied, 475 U.S. 1017 (1986); ACS Hosp. Sys., Inc. v. Montefiore Hosp., 732 F.2d 1572, 1577, 221 USPQ 929, 933 (Fed. Cir. 1984). These showings by the examiner are an essential part of complying with the burden of presenting a prima facie case of obviousness. Note In re Oetiker, 977 F.2d 1443, 1445, 24 USPQ2d 1443, 1444 (Fed. Cir. 1992). If that burden is met, the burden then shifts to the applicant to overcome the prima facie case with argument and/or evidence. Obviousness is then determined on the basis of the evidence as a whole and the relative persuasiveness of the arguments. See Id.; In re Hedges, 783 F.2d 1038, 1039, 228 USPQ 685, 686 (Fed. Cir. 1986); In re Piasecki, 745 F.2d 1468, 1472,

[translation, page 2]. This metallization series is disclosed as including a nitride film. It is the examiner's position that it would have been obvious to the artisan to replace the metal contact of Jackson with a contact having a nitride film as taught by Nirschl.

Appellants make the following arguments: 1) appellants argue that there is no motivation for the artisan to combine the teachings of Nirschl with the teachings of Jackson; and 2) appellants argue that Jackson does not teach the claimed metal nitride film, and Nirschl does not teach the non-single crystal layer comprising indium.

We are not persuaded of error in the rejection by either of appellants' arguments. Appellants' second argument noted above is a classic example of attacking references individually when the rejection is based on a combination of references. None of the deficient teachings pointed to by appellants in the individual references was relied on by the examiner in formulating the rejection. The three components of representative claim 1 are clearly present in the collective teachings of Jackson and Nirschl. The appropriate argument raised by appellants is the propriety of combining these teachings in the manner proposed by the examiner.

223 USPQ 785, 788 (Fed. Cir. 1984); and In re Rinehart, 531 F.2d 1048, 1052, 189 USPQ 143, 147 (CCPA 1976). Only those arguments actually made by appellants have been considered in this decision. Arguments which appellants could have made but chose not to make in the brief have not been considered [see 37 CFR § 1.192(a)].

We consider first the rejection of claims 1-4, 7, 9-14, 17 and 19 based on the teachings of Jackson and Nirschl. These claims stand or fall together as a single group. Representative, independent claim 1 recites an ohmic electrode comprising the following three components: 1) a non-single crystal semiconductor layer comprising indium, 2) a film including at least a metal nitride film, and 3) a III-V compound semiconductor body. Jackson is cited by the examiner as teaching an ohmic electrode having the following three components: 1) a non-single crystal semiconductor layer comprising indium (InAs), 2) a III-V compound semiconductor body (GaAs), and a metal contact [example 3]. The examiner recognizes that Jackson differs from claim 1 only in that Jackson discloses a metal rather than the claimed metal nitride film. Nirschl teaches that it is sometimes desirable to replace simple metal electrodes on III-V semiconductors with a metallization series to create an electrical contact

As noted in the rejection above, the appropriate question becomes the obviousness of replacing the metal of Jackson's example 3 with a metal nitride film or simply adding a metal nitride film to Jackson's example 3 since claim 1 is open ended using the term comprising. Appellants would have us believe that the teachings of Jackson and Nirschl are not combinable because Jackson relates to lower band gap semiconductor materials while Nirschl relates to devices in higher band gap compound semiconductors. We do not agree. Although the examples in Nirschl use substrates made of gallium phosphide (GaP), Nirschl relates to the broader art of ohmic electrodes for III-V semiconductors. The examples of Jackson use a semiconductor body of GaP, GaSb or GaAs, which are all III-V compound semiconductors. Thus, both Jackson and Nirschl relate to the formation of ohmic electrodes on III-V compound semiconductors. Appellants have presented no evidence on this record to support their position that the generic teachings of III-V semiconductors in Jackson are limited to low band compositions or that the generic teachings of III-V semiconductors in Nirschl are limited to high band compositions. We find that Jackson and Nirschl both relate to the more general art of forming ohmic electrodes on III-V compound semiconductors.

With the relationship and combinability of Jackson and Nirsch established, we consider what the collective teachings of this prior art would have suggested to the artisan. Jackson discloses that his metal is tungsten silicide although Jackson indicates that the composition of the metal is not critical [column 6, lines 7-9]. Appellants argue that there is no reason to change the metal disclosed in Jackson, but this argument misses the point. Regardless of the metal used, Nirschl teaches that when one is using III-V semiconductors, it is desirable to replace a single metal contact with a metallization series. Nirschl teaches that regardless of the metal forming layer 2 in his structure, the ohmic contact is improved by adding a metal nitride film over this metal layer 2. Thus, Nirschl would have suggested to the artisan that the single metal contact of Jackson should be replaced by a metallization series including a metal nitride film for reasons suggested by Nirschl. It does not matter what metal is used in Jackson because the Nirschl teachings simply add a nitride film to whatever simple metal is otherwise used. In other words, the artisan would not have to select a different metal in Jackson, but would merely have to add

an additional metallization in the form of a nitride film to achieve more desirable ohmic contact in III-V semiconductors as taught by Nirschl.

Appellants' argument that the cited references fail to address or discuss the problem confronted by them is not persuasive. First, some of the problems identified by appellants in their specification appear to be the same as problems identified by the references such as annealing at high temperature. Second, the test for obviousness is whether the references would have suggested doing what appellants have done. In re Keller, 642 F.2d 413, 425, 208 USPQ 871, 881 (CCPA 1981). Thus, the absence of express suggestion or motivation in the applied prior art is not alone determinative. The prior art need not suggest solving the same problem set forth by appellants. In re Dillon, 919 F.2d 688, 692-693, 16 USPQ2d 1897, 1901 (Fed. Cir. 1990) (in banc) (overruling in part In re Wright, 848 F.2d 1216, 1220, 6 USPQ2d 1959, 1962 (Fed. Cir. 1988)), cert. denied, 500 U.S. 904 (1991). In this case we agree with the examiner that Nirschl would have suggested the obviousness of replacing the simple metal contact of Jackson with a metallization series using an additional metal nitride film for the advantages disclosed by Nirschl.

For all the reasons discussed above, we sustain the examiner's rejection of claims 1-4, 7, 9-14, 17 and 19 based on the collective teachings of Jackson and Nirschl.

We now consider the rejection of claims 5, 6, 8, 15, 16 and 18 based on the collective teachings of Jackson, Nirschl and Ishihara. In addition to the arguments already considered above, appellants argue that there is no motivation to combine the Ishihara teachings with the teachings of Jackson and Nirschl, and that the examiner's mere assertion of the obviousness of specific claimed refractory metal films does not properly support a case of obviousness.

With respect to the first argument, we have already discussed the propriety of combining the collective teachings of Jackson and Nirschl. Nirschl's preferred embodiment also includes an adhesion promoter 6 provided over the metal nitride film. Nirschl teaches that this adhesion promoter can consist of titanium which is a refractory metal. Ishihara also teaches the adhesive properties of a titanium film. The artisan would have found it obvious to add a refractory metal film over the metal nitride film to provide better adhesive properties as suggested by Nirschl.

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With respect to the second argument, although it would have been preferable for the examiner to cite a reference showing the well-known similar characteristics of titanium films and other refractory metal films, we still agree with the conclusion reached by the examiner. In the art of making semiconductors, the artisan was aware that similar properties were obtained from using Ti, W, Ta or Mo. It would have been obvious to the artisan to broadly replace the titanium film disclosed by Nirschl and Ishihara with a W film, a Ta film or a Mo film because of the known similarities between these refractory metals.

Therefore, we also sustain the examiner's rejection of claims 5, 6, 8, 15, 16 and 18 based on the collective teachings of Jackson, Nirschl and Ishihara.

In conclusion, we have sustained each of the examiner's rejections of the appealed claims. Therefore, the decision of the examiner rejecting claims 1-19 is affirmed.

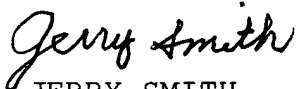
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No time period for taking any subsequent action in
connection with this appeal may be extended under 37 CFR
§ 1.136(a).

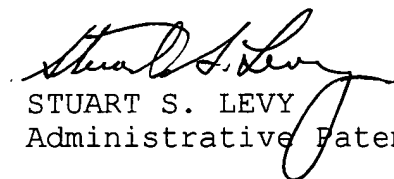
AFFIRMED



KENNETH W. HAIRSTON
Administrative Patent Judge



JERRY SMITH
Administrative Patent Judge



STUART S. LEVY
Administrative Patent Judge

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